Project Introduction

We propose to develop an innovative Autonomous Flight Safety Inference Engine (AFSIE) system to autonomously and reliably terminate the flight of an errant launch vehicle. This proposed phase 1 research is innovative in that it combines proven NASA-developed AFS algorithms, real-time hazard assessment algorithms and hazard envelopes generated from Joint Advanced Range Safety System Real Time (JARSS RT) and an on-board vehicle simulator into a refined onboard software inference engine that monitors navigation states, mission flight rules and onboard anomaly instrumentation. An autonomous flight safety system must be able to reliably perform accurate and autonomous navigation so as to determine the vehicle position, velocity and attitude states in real time. Reliability requirements for AFS are high due to stringent loss-of-life constraints, often leading to redundant navigation sensors with attendant cost impacts. Our innovative solution proposes to satisfy RCC accuracy and reliability requirements by exploiting the low-cost COTS sensor and processor architectures that are currently being baselined for the Common NanoSat/Launcher Avionics Technology (CNAT) study and a Nano launch vehicle avionics design. This dual use hardware implementation will greatly reduce the recurring costs for the production of an autonomous flight safety system. This has significant implications for reducing the costs for launch vehicles, particularly Nano and Micro Satellite Launch Vehicles (NMSLV), where range safety costs currently consume a burdensome percentage of the launch cost. Under this proposed phase 1 effort, we will 1) identify the range requirements and develop a plan for range safety for approval of the system, 2) identify reliable low-cost COTS hardware that satisfies the range accuracy and reliability requirements and, 3) develop an end to end simulation to demonstrate the AFSIE Concept of Operations.
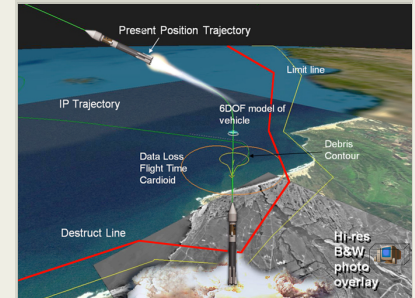
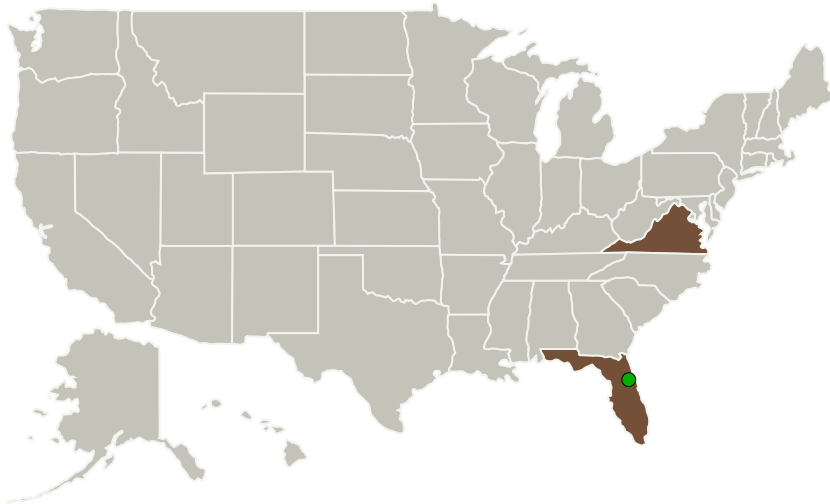Automated Flight Safety Inference Engine (AFSIE) System

Table of Contents

Primary U.S. Work Locations and Key Partners

Organizations Performing Work	Role	Type	Location
Millennium Engineering and Integration Company	Lead Organization	Industry	Arlington, Virginia
●Kennedy Space Center(KSC)	Supporting Organization	NASA Center	Kennedy Space Center, Florida

Primary U.S. Work Locations	
Florida	Virginia

Project Transitions

▶ **May 2013:** Project Start

✓ **November 2013:** Closed out

    Closeout Documentation:
- Final Summary Chart(*https://techport.nasa.gov/file/138011*)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Millennium Engineering and Integration Company

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

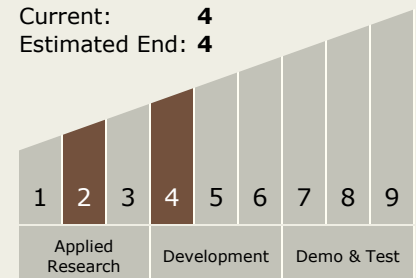**Program Director:**

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Robertson S Augustine

Technology Maturity (TRL)
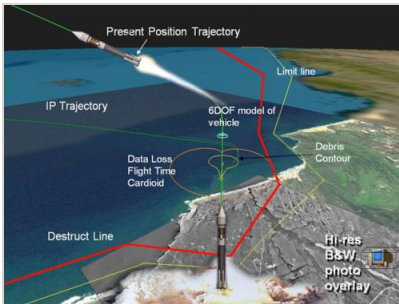
Start: **2**
Current: **4**
Estimated End: **4**

1	2	3	4	5	6	7	8	9
Applied Research			Development			Demo & Test		

Images

Project Image
Automated Flight Safety Inference
Engine (AFSIE) System
*(https://techport.nasa.gov/imag
e/127826)*

Technology Areas

Primary:

- TX13 Ground, Test, and
  Surface Systems
  └ TX13.1 Infrastructure
    Optimization
    └ TX13.1.6 Test,
      Operations, and
      Systems Safety

Target Destinations

The Sun, Earth, The Moon,
Mars, Others Inside the Solar
System, Outside the Solar
System